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THE

COST AND IMPLEMENTATION

OF A

NATIONAL HELIUM CONSERVATION POLICY

designed to prevent the loss into the atmosphere of
any appreciable quantity of helium which has not
first served a useful purpose

(including a discussion of the value of helium)

January 24, 1958

Helium Policy Working Group
Hon. O. Hatfield Chilson
Under Secretary of Interior
Chairman

(Revised and Declassified July 24, 1958)

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I. Foreword

In a letter dated July 1, 1957, Mr. Gordon Gray, Director, Office of Defense Mobilization, suggested to the Hon. O. Hatfield Chilson, Under Secretary of the Interior, that a working group should be established to determine (1) how a national policy designed to prevent the loss of any appreciable volume of helium might be implemented, and (2) how much such a conservation program would cost. In a subsequent letter, dated August 6, Mr. Gray said that he believed the working group should also make an estimate of the value of helium - particularly, to defense and atomic energy programs.

The questions stated by Mr. Gray have been carefully considered by a working group comprised of representatives from the Department of Defense, Department of Commerce, Atomic Energy Commission, Bureau of the Budget, Office of Defense Mobilization, and Department of the Interior. A discussion of the various factors involved in a helium conservation program of the proposed magnitude, together with the working group's conclusions and recommendations, are presented herein.

The working group wishes to acknowledge the very capable assistance of some other individuals in the agencies named above and in the Federal Power Commission. These persons gave generously of their time and energy in providing much of the basic material and evaluations upon which this report is based. The members of the working group and other individuals who contributed to the study are listed below:

Working group members, alternates, and staff:

Department of Interior -

Hon. O. Hatfield Chilson, Under Secretary, Chairman

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Mr. John Liebert, Special Assistant to the Assistant Secretary--Mineral Resources

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Mr. Q. L. Wilcox, Assistant to the Chief, Helium Liaison Office, Bureau of Mines, Chairman, Subcommittee on acquisition of helium-bearing gas fields

Mr. Robert P. Dwyer, Associate Solicitor, Division of Mineral Resources, Chairman, Subcommittee on legislation preventing the marketing of helium-bearing gas

Mr. Joseph M. Hernon, Attorney Adviser, Division of Mineral Resources

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Atomic Energy Commission -

Mr. J. P. Murray, Jr., Attorney, Office of the General Counsel

Bureau of the Budget -

Mr. Joseph H. Mayer, Budget Examiner

Federal Power Commission -

Mr. Carl T. Kallina, Chief, Bureau of Rates and Gas Certificates

O. Hatfield Chilson
Chairman

II. Conclusions

1. The only practical method of conserving the great volumes of helium currently wasted in helium-bearing natural gas consumed as fuel would be to extract the helium prior to transmission of the gas to fuel markets and to store the helium thus conserved in the Government-owned Cliffside gas field or in some other suitable underground reservoir.
    a. It might be feasible to augment this basic conservation plan by acquiring and shutting in relatively small isolated helium-bearing gas fields, but the acquisition of all of the helium-bearing gas fields would not be practical as a basic plan for conservation.
2. Conservation of helium in the above manner would require the construction at the earliest possible date of up to 13 new helium production plants and a pipeline connecting the plants with the Cliffside gas field.
3. A conservation program of this magnitude would cost about 525 million dollars over the period 1960-1975, exclusive of interest on the invested capital and profits. The total cost of the program, including financing costs might be as high as 800 million dollars - depending on how and over what period of time it should be financed.
4. The Government as the dominant helium user would have to pay a proportionately high share of the cost of the program - perhaps as high as 90 percent.

5. Approximately 32 billion cubic feet of helium would be conserved in the period 1960-1975 if the above plan should be implemented promptly.

6. Private industry should be invited to participate in the conservation program and obtain a reasonable return on the required capital investment under conditions that would protect the Government's primary objective of conservation.

7. The most satisfactory form of private participation would involve the sale to the Government of all of the helium produced privately in order that the Government could exercise maximum control over helium production, distribution, end use, and conservation. The Government cannot exercise the maximum control needed to achieve conservation objectives unless it acquires the extraction rights at each source of helium before inviting private participation at each location.

8. Legislative changes would be required, through amendment of the Helium Act or otherwise, to provide additional authorities for the Department of the Interior to deal satisfactorily with private industry - including authority to enter into long-term helium purchase contracts and authority to condemn helium-bearing natural gas after its removal from place of deposit in nature.

9. If private industry should not be interested in participating in the helium conservation program within appropriate limits prescribed by the Government, the program would have to be undertaken as a Government operation.

10. It was not possible to assign a dollar value to the savings that would accrue to the United States as a result of helium conservation in the time allotted. However, after study it became obvious that the present and foreseeable importance of helium to the national welfare - especially with respect to its military strength - is sufficient to warrant urgent consideration of a conservation program of the magnitude described above.

Some evidence of the true value of helium might be obtained if a substantial increase in its selling price could be authorized. Such would not be possible without an amendment to the Helium Act.

III. Recommendations for the Implementation of a National Policy to Prevent Loss of Helium

1. Additional helium plants should be constructed to extract for conservation approximately 32 billion cubic feet of helium that would otherwise be lost and wasted in natural gas consumed as fuel. These plants should be constructed as rapidly as gas processing agreements, engineering details, and funds can be made available.

2. A pipeline system should be constructed to interconnect the helium plants with the Government-owned Cliffside gas field near Amarillo, Texas, in order that the conserved helium could be transmitted there for storage until needed.

3. A public announcement should be made at an appropriate time that the participation of private industry is invited in the production of helium for sale to the Government for conservation.

   a. The Government should acquire through negotiation if possible and by condemnation if necessary, helium extraction rights at all of the possible plant sites. Control of the basic supply of helium would enable the Government to extract the helium or subsequently to assign the extraction rights to private companies. This would assure the control needed to accomplish conservation objectives and would eliminate bidding of one company against another which could result in unduly increased costs.

4. Suitable legislation should be prepared by the Department of the Interior and submitted to the Congress to provide additional authorities that would be required by the Department in administering the helium conservation program - including the authority to enter into long-term helium purchase contracts with private companies and authority to condemn helium-bearing natural gas after its removal from place of deposit in nature.

5. The Government should undertake as a Government operation any part of the conservation program that private industry does not indicate a willingness and capability to perform in a reasonable time.

6. Insofar as economically feasible, the price of helium sold for current usage should be high enough to cover the costs of the helium conservation program in addition to the costs of producing helium for sale.

    a. Information supplied by the Bureau of Mines indicates that it would be possible to cover the operations and maintenance costs of conservation over the period 1960-1975 by increasing the sales price to about $44.50 per thousand cubic feet. Then, if the $44.50 price should be continued, the capital investment in conservation facilities and financing costs would be covered by about 1985.

    b. The sales price of helium cannot be raised to the level suggested above without an amendment to the Helium Act as proposed under "Required Legislation" (page 16).

IV. Discussion

A PLAN FOR CONSERVATION

The only practical method of conserving the large volumes of helium currently wasted to the atmosphere is to construct and operate helium plants to extract the helium from helium-bearing natural gas before it is transmitted to fuel markets, and to store the helium thus conserved in the Government-owned Cliffside gas field or some other suitable underground reservoir. Whenever it is practical and economical to do so, this basic plan might be augmented by the acquisition of relatively small isolated helium-bearing gas fields.

Ninety-nine percent of the known helium-bearing natural gas resources in the United States is concentrated in four fields: (1) the Hugoton field of Texas, Oklahoma, and Kansas; (2) the Panhandle field of Texas; (3) the Keyes field of Oklahoma; and (4) the Greenwood field of Kansas. All of these fields have been developed by private companies to supply natural gas to fuel markets, and they are presently being produced for that purpose. So far as the gas companies are concerned, the helium is a minor impurity, and no effort is made to remove it. Consequently, the helium is transmitted to fuel markets along with the rest of the gas, and it eventually passes through the gas burners into the atmosphere without serving any useful purpose.

The Hugoton, Panhandle, Keyes, and Greenwood fields contain approximately 119 billion cubic feet of potentially recoverable helium. About 60 percent of this helium could be recovered in 13 helium plants

located at strategic points on pipelines leading from the fields. The construction of these plants, as suggested by the Bureau of Mines, is the best plan submitted to date for implementing a helium conservation program.

Information is incomplete regarding the number and size of additional plants that would be required to process for helium extraction all of the helium-bearing gas not available to the 13 proposed sites. Such plants would be small and marginal in many respects, and the advisability of constructing them to comply fully with the policy statement concerning the wastage of any appreciable volume of helium appears to warrant further consideration.

A major part of the conservation can be accomplished by prompt action to construct and operate the 13 plants recommended by the Bureau of Mines. These plants, plus 4 existing plants, would recover an estimated 43.5 billion cubic feet of helium by 1975. Estimated sales demand in the period is 11.5 billion cubic feet, leaving 32 billion cubic feet for conservation in underground storage. This plan would offer reasonable assurance of meeting anticipated peacetime helium requirements to the year 2000.

In addition to the helium plants, a small pipeline system would be required to connect the plants with the Government-owned Cliffside field in order that the conserved helium could be transported there for storage. More than 32 billion cubic feet of helium-bearing gas has been produced from the Cliffside field since its discovery; consequently, the

field has the capacity to store an equal amount of helium without exceeding the original field pressure. When the helium is subsequently withdrawn from storage, it would need to be purified for sale and use, but the cost of purification would be less than half of the initial cost of production.

THE COST OF CONSERVATION

Conservation of helium as described above would require the construction of 13 plants and a connecting pipeline at an estimated cost of 238 million dollars. An additional 382 million dollars would be required over the period 1960-1975 to cover the out-of-pocket operation and maintenance costs at the 13 plants. Thus, the total expenditures for constructing, operating, and maintaining the plants over the period 1960-1975 would be about 620 million dollars.

Approximately 85 percent of the helium produced at the 13 plants through 1975 would be conserved (about 15 percent would be sold to meet current demands); consequently, the expenditures attributable to the conservation program in this period would be about 85 percent of 620 million dollars, or 525 million dollars.

This estimate of 525 million dollars is a minimum figure as it includes only capital expenditures plus out-of-pocket costs. If the cost of financing the program is included, the resultant over-all 1960-1975 cost would be considerably higher - possibly as much as 300 million dollars higher, depending on how the program is financed and over what period of time.

The Government is the dominant user of helium and would be required to pay a proportionately large share of the cost of helium conservation. At the present time, the Government is using directly about 70 percent of the helium produced by the Bureau of Mines, and more than half of the 30 percent sold to industry is used on Government contracts. The Government might expect, therefore, to pay from 70-90 percent of the conservation costs.

The Working Group recommends that the cost of helium conservation should be included in the price of helium sold to various users. This would not lessen the financial burden on the Government, but it would distribute the conservation costs among the agencies that use the helium and enable the program to be administered in a business-like manner.

There are many uncertainties in determining the price that would have to be charged for sales helium to provide enough revenue to defray the costs of producing both sales and conservation helium. One important controlling factor is the future relationship between the volume of helium sold to the volume conserved. Based on present day costs and expenses, and on the best available estimates of future helium sales, the operation and maintenance costs of producing 32 billion cubic feet of conservation helium could be recovered over the period 1960-1975 by charging $44.50 per 1,000 cubic feet of helium sold. If this price should be continued through 1985, it is estimated that the revenue should be sufficient to retire the capital investment and pay deferred interest charges that would accrue during the early years of the program.

PRIVATE PARTICIPATION

The Working Group believes that private industry should be given an opportunity to participate in the helium conservation program. Previous surveys of industry have developed little in the way of serious interest to risk private capital in the helium business. However, in recent weeks a decided change appears to have taken place in industry thinking. Several reputable companies have stated their interest in participating in the helium program on the basis of constructing helium extraction plants with private capital. The prospects for developing private participation thus appear definitely brighter than they did only six months ago. Such participation would, however, present several problems. A completely private helium industry would result in the promotion of helium sales regardless of end use, and thus defeat in some measure the primary objective of conservation. Furthermore, the cost of production at the 13 plant locations would vary widely (as much as 3 to 1) because of variations in helium content, gas supply conditions, and other factors. Under such conditions, it would be extremely difficult for private plants at the various locations to compete with one another so far as helium sales price is concerned.

In view of the foregoing, it is believed that the most satisfactory form of private participation would involve the purchase by the Government of all of the helium produced privately. Such a plan would give the Government approximately the same control over the production, distribution, and use of helium as could be achieved through Government

ownership and operation of the facilities. It would also enable the Government to sell helium to meet current demands at a reasonable price based on the average cost of producing helium at all of the plants, and thus utilize the profits accruing from the low-cost plants to offset the losses at high-cost plants. This advantage would be lost if private industry should be encouraged to produce and market helium from the most desirable locations without Government controls, leaving the less desirable sites for development with Government funds.

Another problem would arise if private companies should attempt to bid against one another for the right to extract helium from helium-bearing natural gas at the various plant sites. Such a development would not adversely affect the profits of the companies, as the resultant high processing costs could be passed on to the Government; however, the result, so far as the Government is concerned, is readily apparent. Furthermore, at such time as legislation is enacted in accordance with recommendation 4 on page 9, providing authority to the Government to condemn helium-bearing natural gas, the Government would be in a more favorable position to negotiate extraction rights than would private industry. It appears desirable, therefore, that the Government contract for helium extraction rights which can be made available to private companies interested in building and operating plants to extract helium for sale to the Government.

If private industry is not interested in participating in the helium conservation program under terms and conditions that would satisfy the Government's interests and if helium is to be conserved, the Government will have to construct and operate the 13 plants (12 plants in addition to the one contemplated for Keyes, Oklahoma). The Bureau of Mines constructed four new plants in a very short time during World War II, and a similar procedure using private architect-engineer and construction organizations might be followed again.

REQUIRED LEGISLATION

At least three changes would be required in the Helium Act (50 Stat. 885; 50 U.S.C. 161, 163-166) to facilitate the helium conservation program.

1. The Act should be amended to permit the Department of the Interior to enter into long-term contracts with industry for the purchase of helium for conservation. It is very unlikely that private industry would consider financing helium production plants without reasonable expectation that the investment plus a profit would be recovered in a reasonable time. Fixed-price contracts would be desirable in that a degree of risk would be shared by industry. Such contracts would also provide incentive to industry to keep production costs down in order to improve their profits.

2. The Act should be amended to permit the Department of the Interior to raise the price of helium to the level needed to cover the cost of the helium conservation program in addition to the cost of producing helium for sale.

3. The Act should be amended to provide for condemnation of helium-bearing natural gas after its removal from place of deposit. As presently written, the Act provides authority for condemnation of helium-bearing natural gas in place only, and the Government could, if circumstances warrant, acquire an entire helium-bearing gas field through condemnation proceedings.

   Such action would be appropriate if the Government should desire to acquire and shut in an entire field. If the Government should only wish to extract the helium, or have the helium extracted in its behalf, before the combustible portion of the gas is transmitted to fuel markets, however, the condemnation of an entire field would give the Government a much greater right in the field than would be required under such circumstances and place the Government very much in the natural gas business.

   What the Government really needs is the right to extract helium from privately-owned transmission lines. Legal opinion indicates that it may not be possible to acquire such a selective right by condemnation, and that the only way to accomplish a similar end may be to condemn all of the gas in the pipeline, extract the helium, and resell the residue gas to the gas company.

ALTERNATE PLANS ARE NOT FEASIBLE

Two alternate plans for helium conservation were considered by the Working Group. Neither of the plans was considered to be feasible.

1. Acquisition of helium-bearing gas fields

Conservation of helium in the Hugoton, Panhandle, Keyes, and Greenwood fields by Government acquisition of the fields would not be feasible because of the serious adverse effect such a plan would have upon a large segment of the public.

These fields contain 15 percent of the total natural gas reserves in the United States, and they provide fuel gas to 15 million domestic and industrial consumers. There is not enough undedicated natural gas available from other sources to serve these markets. It would be unthinkable to cut off the source of fuel to these consumers except as a last resort. The probable cost of acquisition of the fields and related facilities (estimated at 7.2 billion dollars) and the inherent difficulties in acquiring properties in which there are thousands of leasehold and other interests are also major deterrent factors.

Although it would not be practical to acquire all four of the fields and thus conserve the helium therein, it might be feasible to acquire part or all of the two smaller fields - Keyes and Greenwood. The estimated costs of acquiring these fields are relatively low (Keyes - 95.5 million dollars; Greenwood - 323 million dollars), and it might be possible to obtain gas from other sources to replace them.

Acquisition of even these smaller fields should be undertaken only as a last resort.

2. Legislation prohibiting the marketing of helium-bearing gas prior to helium extraction

It would be possible to conserve the helium currently wasted in fuel gas through appropriate legislation prohibiting the marketing of such gas prior to helium extraction, if it should be possible to get such legislation enacted. It is believed that such legislation would be constitutional and it would place the burden of helium extraction upon the natural gas companies if they wished to continue to do business.

It is very unlikely, however, that such legislation would be enacted into law - especially when there is an acceptable alternate method of conserving the helium. The legislation would threaten to disrupt fuel gas deliveries to millions of consumers, and undoubtedly, it would be vigorously opposed by all segments of the natural gas industry - producers and consumers alike.

THE VALUE OF HELIUM

The Working Group was unable to find a basis for defining the dollar savings that would accrue to the Nation from a helium conservation program. It is obvious that in some areas such as naval airships, aerology, and a few other applications, the use of substitutes for helium risks the loss of human life. It is also obvious that the use of substitutes in other areas such as guided missiles, certain welding operations, aeronautical research, and elsewhere would result in loss in efficiency of U.S. weapons and industrial products. The Atomic Energy Commission reports that it has no current knowledge of satisfactory

substitutes for helium in its large scale uses, and that if it were premised that helium would no longer be available in quantity, the Atomic Energy Commission would have to begin extensive research projects to develop alternate materials or processes which might take years and could be very costly.

In view of these circumstances, the Working Group is convinced that present and foreseeable uses of helium are highly essential to the welfare of the United States - particularly with respect to its military strength - and a conservation program of the magnitude discussed herein would be justified. Failure to extract the recoverable helium that would be wasted to the atmosphere in fuel gas in the absence of a conservation program over the next 15-20 years would be gross wastage of a very limited and unique natural resource, which could have the effect of reducing or slowing down the rapid advance of scientific, technical, and military developments in this Country.